



ECH 400

4-step Chiller and Heat Pump Controller

Technical Data Sheet

GENERAL DESCRIPTION

ECH 400



ECH 400 is a compact device for controlling a chiller and heat pump for the following types of conditioning:

- air-air
- air-water
- water-water
- air-water
- motor-condensing

The controller is able to control up to 4 power steps in a maximum of 2 cooling circuits (e.g. : 2 circuits and 2 compressors per circuit).

The controller consists of 2 elements: the power card and user interface. The power panel fitted behind the panel has all the relays and digital/analogue inputs needed to control typical air conditioning applications.

The overall dimensions are compact to reduce panel space for electrical connections;

It is easy to install by using quick-fit connectors.

MODELS

CODE	MODEL	DESCRIPTION
MW324000	ECH 420	HEAT PUMP WITH 4 STEPS/ 2 CIRCUITS + MODBUS
MW324005	ECH 420/V	WITH SCREW CONNECTORS
MW324006	ECH 420/FV	WITH FREECOOLING AND SCREW CONNECTORS
MW324600	EKW 400	REMOTE TERMINAL FOR ECH 400, WALL MOUNT
MW324650	EKP 400	TERMINALE TERMINAL FOR ECH 400, PANEL MOUNT

FUNCTIONS

- Hot/cold adjustment;
- Controls 1, 2, 3, 4 compressors.
- Water temperature control at outlet.
- Condensation control
- Dynamic set point
- Automatic change-over
- Electrical heater controllers for anti-freeze or integration with heat pump;
- Continuous control of condenser fan speed by external device (CF module);
- Defreezing cycle control;
- Water pump cycle operation control
- Hot Start
- Anti-freeze
- Remote selection of hot/cold mode;
- Temperature or pressure operation
- Parameters can be set from keyboard by using a Personal Computer or copy card;
- User interface with a menu featuring 2 different levels of access through password management
- Complete alarm diagnostics.
- Differential temperature controller;
- Recording of on-duty hours
- Facility for interfacing with BMS via Modbus protocol

ACCESSORIES

- Expansion module: makes it possible to add another 4 analogue inputs, 4 digital inputs and 2 digital outputs.
- Copy card for uploading and downloading parameter maps
- Remote keyboard (up to 100 m) which may be connected up directly without a serial interface
- CF Modules for commanding condenser fans with current rating of over 2A.
- Interface Module for connection to personal computer
- Software "Param Manager" controlled by personal computer
- Temperature probes
- Pressure transducers
- Power transformers
- Front panel Protection

INSTALLATION

OUTPUTS

The instrument has the following outputs:

- 8 relay contacts
- 4 low voltage outputs;
- Serial outputs

Relays

The following configurations are available:

RL1	Compressor 1
RL2-RL7	Configurable: <ul style="list-style-type: none"> • Disabled • Circuit 1 reversal valve • Circuit 2 reversal valve • Circuit 1 condenser fan • Circuit 2 condenser fan • Heater 1 • Heater 2 • Pump • Evaporator fan • Power step 2 • Power step 3 • Power step 4
RL8	Cumulative alarm

Triac

Phase cutting outputs:

NOTE: LOW VOLTAGE OUTPUTS

TC1	Output for piloting fan external modules for circuit 1.
TC2	Output for piloting fan external modules for circuit 2.

4-20mA outputs:

AN1	Output for controlling fans for circuit 1
AN2	Output for controlling fans for circuit 2

Serial outputs

There are 2 asynchronous outputs on the control:

- channel for serial communication with a personal computer through a suitable interface module (9600,e,8,1).
- channel for serial communication with a suitable keyboard. Power supply 12 VDC (2400,e,8,1).

ANALOG INPUTS

There are 6 analogue inputs:

- 4 NTC temperature sensors (10K at 25°C),
- 2 configurable transducers NTC/4-20mA.

The following configurations are available:

ST1	<ul style="list-style-type: none"> • Probe absent • NTC input: water/air at input • Digital input: request for heating • Digital input: temperature controller request • differential NTC input
ST2	<ul style="list-style-type: none"> • Probe absent • NTC input Outlet water/air, anti-freeze • Digital input: Cooling request
ST3	<ul style="list-style-type: none"> • Probe absent • NTC input: condensation • Input 4.-20mA for condensation • Input 4-20 mA for dynamic setpoint anti-freeze electrical heater output for water-water machines with gas reversal • NTC in heating controller for water-water reversal machines
ST4	<ul style="list-style-type: none"> • Probe absent • NTC input: condensation • Multifunctional digital input • NTC input: outdoor temperature
ST5	<ul style="list-style-type: none"> • Probe absent • NTC input: water/air at input
ST6	<ul style="list-style-type: none"> • Probe absent • NTC input: condensation 2 • Input 4.-20mA for condensation anti-freeze electrical heater output for water-water machines with gas reversal

DIGITAL INPUTS

There are 11 voltage-free digital inputs – ST1, ST2 and ST4 can be added to them, if configured as digital inputs..

All digital inputs are configurable and can have the following meanings:

ID1-ID11	<ul style="list-style-type: none"> • Output disabled • Flow switch • Remote OFF • Remote heat cool • Thermal switch for compressor 1 • Thermal switch for compressor 2 • Thermal switch for compressor 3 • Thermal switch for compressor 4 • Thermal switch for circuit 1 fan • Thermal switch for circuit 2 fan • Circuit 1 high pressure • Circuit 2 high pressure 2 • Circuit 1 low pressure • Circuit 2 low pressure • High Pressure compressor 1 • High Pressure compressor 2 • High Pressure compressor 3 • High Pressure compressor 4 • Circuit 1 end of de-freezing • Circuit 2 end of defreezing • 2nd power step request • 3rd power step request • 4th power step request
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NOTE: Polarities can be configured.

USER INTERFACE

The interface, on the instrument front panel, enables all the instrument's operations, and especially the following:

- Set operation mode
- Control alarm situations
- Check status of resources

Front panel



KEYS








	<ul style="list-style-type: none"> • Actuates alarms reset and instrument switch-on and -off. • In the menu mode, it becomes the SCROLL DOWN or DOWN key (value reduced)
	<ul style="list-style-type: none"> • In heat mode, whenever you press this key, the sequence is: Stand-by → cooling → heating → stand-by • if heat mode is not enabled: Stand-by → cooling → stand-by • In the menu mode, it becomes the SCROLL UP or UP key (value increased)
	<p>If you press and release both keys within 2 seconds, you drop down by one level in the viewing menu. .</p> <p>If you press and release both keys within 2 seconds, you rise by one level</p>

DISPLAY

The following are shown under normal viewing:

- control temperature in tenths degrees Celsius or Fahrenheit
- alarm code, if at least one alarm is active. If several alarms are active, the first is shown according to the Alarms Table.
- If temperature control is not analogic and depends on the status of a digital input (ST1 or ST2) configured as digital inputs) the "On" or "Off" label is used according to temperature controller status (active - inactive).
- In menu mode, the display depends on its current position. Labels and codes are used to help the user identify the set function.

LED

	
	
	
	
	<ul style="list-style-type: none">ON if the anti-freeze internal heater or boiler are activeOFF if the anti-freeze internal heater or boiler are inactive
	ON if the device is in heating mode.
	ON if controller in cooling mode

WALL KEYBOARD (REMOTE)

Remote keyboard



Functions are identical to those listed in the displays section.

The only difference is the use of the UP and DOWN keys (increase and reduction of value) which are separated from the MODE and ON/OFF keys (see photo).

PARAMETERS

By means of a set of parameters, one can set the different types of machine and the operating values of the different algorithms. Parameters can be set in the following ways:

- instrument keyboard
- Copy Card
- Through PC (with software Param Manager and interface module).

Viewability or non viewability of parameters and labels can be programmed from the Personal Computer.

TEMPERATURE CONTROL FUNCTIONS

OPERATING MODES

The controller is able to manage single- or multi-stage compressors for one or two cooling circuits. The control has 4 operating statuses:

- cooling
- heating
- stand-by
- off

The operating mode can be selected from the keyboard or from the digital inputs according to set parameters.

Unless the machine is configured as a motorised condensing type, activation and de-activation of loads depends dynamically on the set temperature control functions, on the temperature/pressure values measured by the probes and on setpoints.

DYNAMIC SETPOINT

The regulation algorithm may be used to modify the set point automatically on the basis of outdoor conditions.

The purpose is to save ECH and to compensate for drops in machine performance if outside temperatures are particularly demanding. .

AUTOMATIC CHANGE-OVER

Changes from cooling to heating according to parameters and ambient conditions.

DIFFERENTIAL TEMPERATURE CONTROL

Used to control temperature according to the two inputs. With this type of control, for example, a fluid can be thermostat controlled whether in cooling or heating mode, setting the fluid equal to outside ambient temperature plus a constant differential (positive or negative) set by the user

CONDENSATION CONTROL

All controllers in the ECH 400 family control condenser fan speed. They do so by means of external modules, according to condenser temperature/pressure and selected parameters. Additionally, ECH 400 includes all functions and protective devices to ensure efficient fan operation (cut-off, bypass...)

A "silent" speed can be set for silenced operation (e.g. for nights).

DEFROSTING

Defrosting is active in HEAT mode only. It is used to prevent ice forming on the surface of the outside exchanger. Ice significantly cuts down the machine's thermo-dynamic performance and may lead to damage.

The defrosting cycle can be controlled for one condenser or for two separate ones, and defrosting control can be managed with either one or two condenser probes, according to internal parameters.

INTEGRATING ELECTRICAL HEATERS

The controller is able to control electrical heaters in order to integrate heating with the heat pump configuration. . The air supplied by the internal exchanger is further heated according to parameters and ambient conditions.

ANTI-FREEZE

If a refrigerating water internal exchanger is supplied, this function prevents water icing in cooling mode, by activating a heater

DISCHARGED MACHINE

A machine functionality check is performed in all operating modes (defrosting excluded) to detect any leaks in the gas circuit or any reversal valve faults. When the controller detects these problems, all outputs are disabled.

INTERNAL FAN

Up to 3 inputs can be configured to command the same number of fan speeds in the internal exchanger

RECORDING OF DUTY HOURS

The device stores the number of duty hours of the following in the permanent memory:

- hydraulic pump
- compressors

DIAGNOSTICS

The controller can perform full systems diagnostics of the machine and signal alarms.

For some alarms the signal will not be given for a certain amount of time, preset by a parameter. For others, the number of tripping events/hour is counted. If, in the space of one hour, these events exceed a set threshold established by means of a parameter, an alarm is activated and is then manually reset.

Alarms with manual reset are reset by pressing the ON-OFF button.

When an alarm is triggered, two things occur:

- Corresponding loads are shut down
- The alarm is indicated on the keyboard display

The alarm/event messages are identified by labels (code errors Exx).

USE CONDITIONS

PERMITTED USE

This product is used to control single circuit chillers and heat pumps.

To ensure safety, the controller must be installed and operated in accordance with the instructions supplied, and access to high voltage components must be prevented under regular operating conditions. The device must be properly protected against water and dust and must be accessible by tool only. The device is suitable for installing in a household appliance and/or similar air conditioning device.

According to the reference regulations, it is classified:

- In terms of construction, as an automatic electronic control device to be incorporated with independent assembly or integrated;
- In terms of automatic operating characteristics, as a type 1 action control device, with reference to manufacturing tolerances and drifts;
- As a class 2 device in connection with protection against electrical shock;
- As a class A device in connection with software structure and class.

FORBIDDEN USE

Any use other than permitted use is forbidden. Please note that relay contacts supplied are functional and are subject to faults (as they are controlled by an electronic component and may be shorted or remain open). Protective devices recommended by product standards or suggested by common sense in response to evident safety requirements must be implemented outside of the instrument.

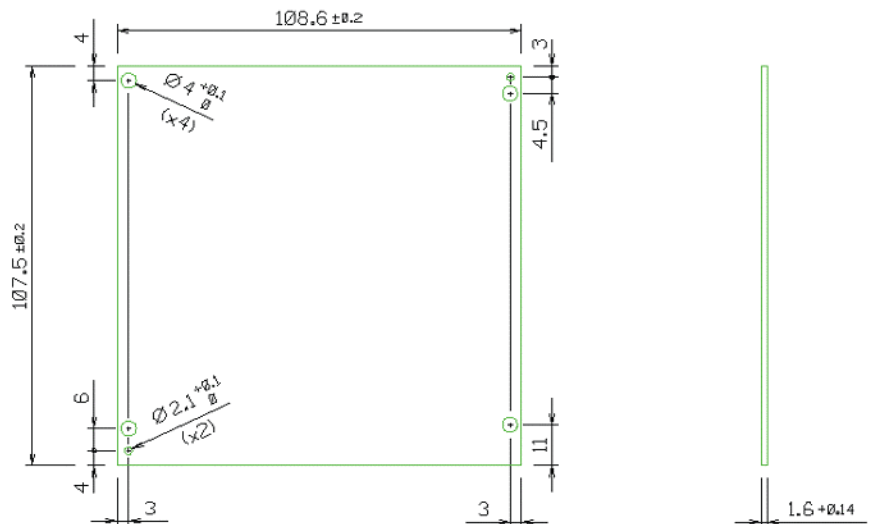
RESPONSIBILITY AND RESIDUAL RISKS

The Constructor shall not be held liable for any damage due to:

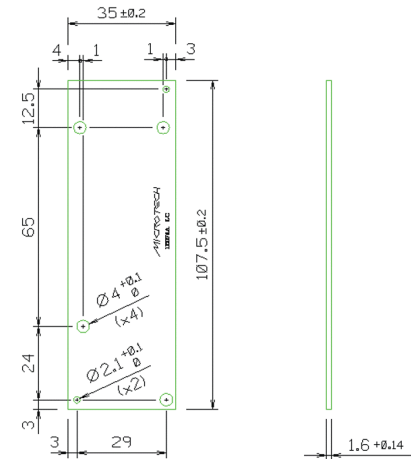
- installation/use other than those intended, and, in particular, failure to comply with the safety instructions specified by current regulations and/or provided in this document;
- use with equipment which does not provide adequate protection against electric shocks, water and dust under the effective conditions of installation;
- use with equipment which permits access to hazardous parts without the use of tools;
- installation/use with equipment which does not comply with current regulations and legislation.

DIMENSIONS AND ASSEMBLY

Dimensions of basic module

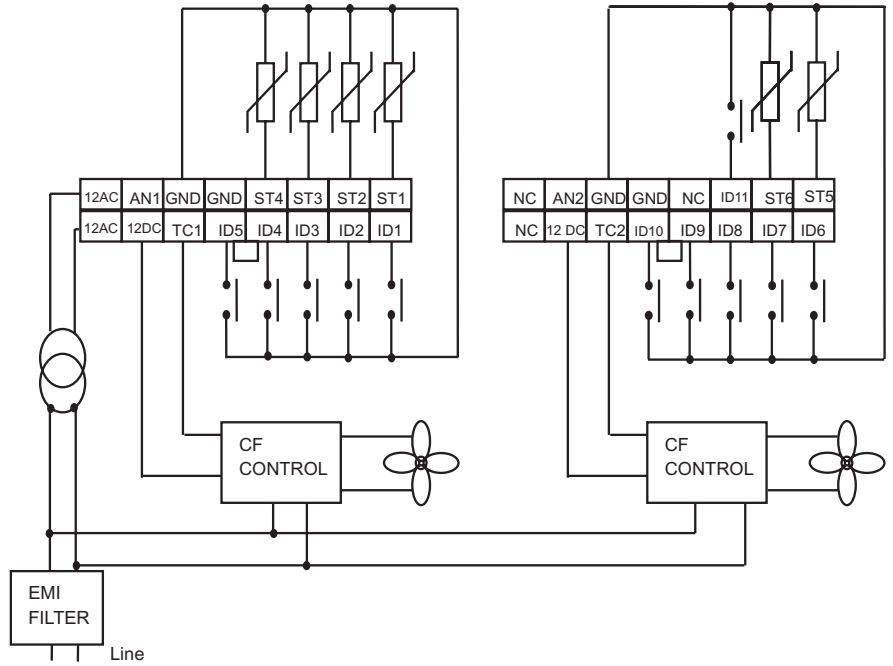
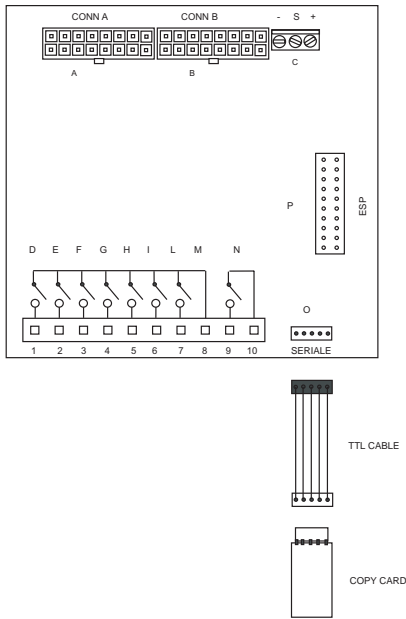


Expansion dimensions



CONNECTION DIAGRAMS

Detail of connectors with NTC sensors

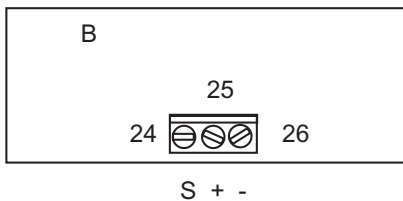
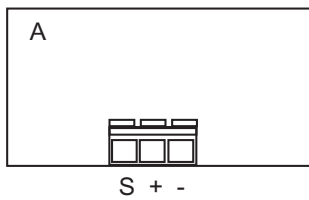


Detail of connectors with pressure sensors

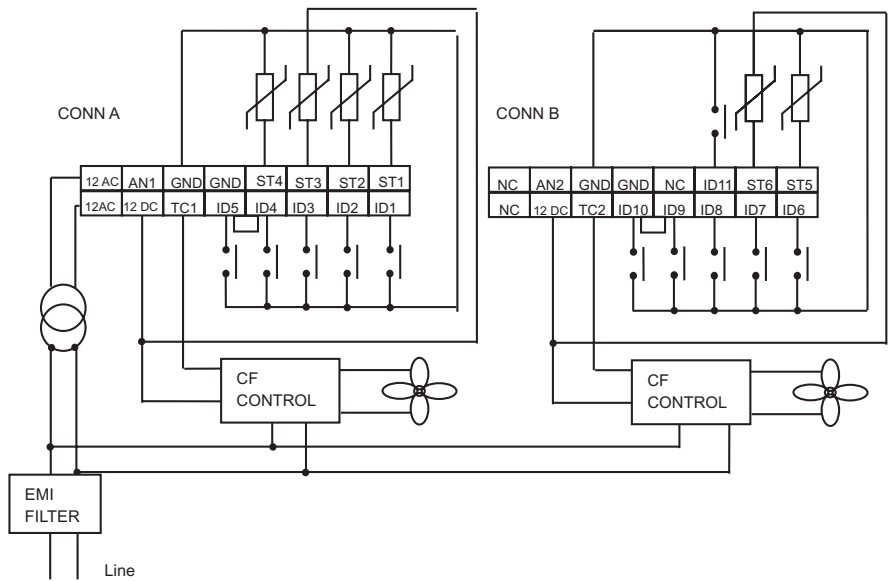
Basic module

A CONNECTOR A	H RELAY 5
B CONNECTOR B	I: RELAY 6
C REMOTE KEYBOARD	L: RELAY 7
D RELAY 1	M: COMMON CONTACT FOR RELAY
E RELAY 2	N: ALARM RELAY
F RELAY 3	O: SERIAL
G RELAY 4	P: EXPANSION

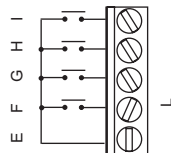
Keyboard connections



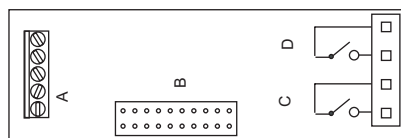
A REAR: FLUSH- MOUNTED KEYBOARD
B REAR: PANEL-MOUNTED KEYBOARD



Expansion connections



A CONNECTOR A	F ID12
B EXPANSION	G ID13
C RELAY 9	H ID14
D RELAY 10	I: ID15
E COMMON CONTACT	L: CONN C



TECHNICAL DATA

TECHNICAL DATA

	Typical	Min.	Max.
Power supply voltage	12V~	10.8V~	13.2V~
Power supply frequency	50Hz/60Hz	---	---
Power	11VA	---	---
Insulation class	1	---	---
Protection class	Front IP0	---	---
Operating temperature	25°C	-10°C	60°C
Operating ambient humidity (non-condensing)	30%	10%	90%
Storage ambient temperature	25°C	-20°C	85°C
Storage ambient humidity (non-condensing)	30%	10%	90%

DISCLAIMER

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ELECTROMECHANICAL

FEATURES

Digital outputs 110/230 V	n° 8 relays 5 A resistive; ¼ hp 230VAC; 1/8 hp 125VAC (base) Total current on relays must not exceed 10A n° 2 relays 5 A resistive; ¼ hp 230VAC; 1/8 hp 125VAC (expansion)
Analogue outputs	n° 2 outputs, triac piloting LOW VOLTAGE or 4-20 mA configurable
Analogue inputs	n° 4 NTC R ₂₅ 10KΩ n° 2 configurable outputs 4-20mA / NTC R ₂₅ 10KΩ
Digital inputs	N° 11 Voltage-free digital inputs (base) n° 4 Voltage-free digital inputs (expansion)
Terminals and connectors	n° 1 Connector 10-way high voltage step 7.5 n° 2 Connectors 16-way, snap-fit, low voltage, step 4,2, AWG 16-28 n° 1 Connector p2.5 5-way remote control and memory card, AWG 24-30 n° 1 Connector 20-way expansion connection n° 1 terminal 3-way for remote keyboard
Serial lines	n° 1 serial line 9600 n° 1 serial line 2400 remote keyboard

The instrument must be powered by a suitable current transformer with the following characteristics:

- Primary voltage: 230V~±10%;
110V~±10%
- Secondary voltage: 12V~
- Power supply frequency: 50Hz; 60Hz
- Power: 11VA;

